

## Abstract of the Disclosure

5 An optical identification element 8 includes an optical substrate 10 having at least one diffraction grating 12 disposed therein. The grating 12 has a one or more of  
colocated pitches  $\Lambda$  which represent a unique identification N bit digital code that is  
detected when illuminated by incident light 24. The incident light 24 may be directed  
transversely onto the side or onto an end of the substrate 10 with a narrow band  
(single wavelength) or multiple wavelength source, in which case the code is  
represented by a spatial distribution of light or a wavelength spectrum, respectively.  
10 The element 8 can provide a large number of unique codes, e.g., greater than 67  
million codes, and can withstand harsh environments. The element 8 can be used in  
any application that requires sorting, tagging, tracking or identification, and can be  
made on a micron scale “microbeads” if desired, or larger “macro-elements” for  
larger applications. The code may be digital binary or may be other numerical bases.

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